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Infect Control Hosp Epidemiol 2007; 28:507-509

 0899-823X/2007/2804-0026$15.00. DOI: 10.1086/518096

REFERENCES

1. O'Neil TM, Abbott AV, Radecki SE. Risk of needlesticks and occupational exposures among residents and medical students. *Arch Intern Med* 1992; 152:1451-1456.
2. Resnic FS, Noerdlinger MA. Occupational exposure among medical students and house staff at a New York City Medical Center. *Arch Intern Med* 1995; 155:75-80.
3. Radecki S, Abbott A, Eloi L. Occupational human immunodeficiency virus exposure among residents and medical students: an analysis of 5-year follow-up data. *Arch Intern Med* 2000; 160:3107-3111.
4. Heald AE, Ransohoff DF. Needlestick injuries among resident physicians. *J Gen Intern Med* 1990; 5:389-393.
5. Osborn EH, Papadakis MA, Gerberding JL. Occupational exposures to body fluids among medical residents: a seven-year longitudinal study. *Ann Intern Med* 1999; 130:45-51.
6. Guo YL, Shiao J, Chuang YC, Huang KY. Needlestick and sharp injuries among health-care workers in Taiwan. *Epidemiol Infect* 1999; 122:259-265.
7. McGeer A, Simor AE, Low DE. Epidemiology of needlestick injuries in house officers. *J Infect Dis* 1990; 162:961-964.
8. Patterson JM, Novak CB, Mackinnon SE, Ellis RA. Needlestick injuries among medical residents. *Am J Infect Control* 2003; 31:226-230.
9. Sohn S, Eagan J, Sepkowitz KA, Zuccotti G. Effect of implementing safety-engineered devices on percutaneous injury epidemiology. *Infect Control Hosp Epidemiol* 2004; 25:532-535.

Incidence of Legionellosis in Hospitals Contaminated by *Legionella pneumophila* Other Than Serogroup 1

TO THE EDITOR—In the late 1990s, following outbreaks of isolated cases or clusters of legionellosis in several Turin hospitals, the district attorney's office ordered all hospitals in its jurisdiction to monitor their water distribution systems. In response, Piedmont hospitals initiated surveillance and control measures to fully decontaminate their water distribution systems, regardless of whether legionellosis cases had occurred at the facility. Our department's involvement in evaluating the effectiveness of the decontamination interventions enabled us to gain a fairly complete picture of the situation at 36 hospitals, 35 of which were contaminated (61% of samples tested positive for *Legionella* species, with bacterial loads ranging from 100-10,000 cfu/L). Of the *Legionella* species isolated, *Legionella pneumophila* occurred most frequently; among the most common circulating serogroups were serogroup 6 (found at 15 hospitals), serogroup 3 (found at 12 hospitals), and serogroup 1 (found at 11 hospitals). Other species isolated (*Legionella micdadei, Legionella steigerwaltii,* and other unidentified strains) were consistently associated with *L. pneumophila.*[1]

Concerned about legal action the magistrate's office could take against them if there was *Legionella* contamination in their water distribution systems, the hospital administrations initiated disinfection procedures recommended by guidelines (chlorination and thermal shock) or alternative methods (eg, disinfection with peracetic acid,[2] ozone, and/or hydrogen peroxide), independently of the observed bacterial load or the presence of legionellosis cases. In the end, huge costs were incurred to obtain an effect that was as questionable as it was transient.

In this context, we invited the hospital administrations to participate in a 2-year project (2001-2002) that had the following objectives: to verify the incidence of nosocomial legionellosis in those hospitals contaminated with *L. pneumophila* other than serogroup 1 or with non-*pneumophila* species of *Legionella,* where only regular ordinary maintenance without decontamination measures would be carried out; and to monitor environmental contamination levels without decontamination measures.

In agreement with the medical departments of the hospitals participating in the project, the following protocol was set up. First, preliminary evaluation of environmental contamination was done. No environmental decontamination intervention was initiated at the central or peripheral parts of the water distribution system. Hospitals performed normal maintenance, defined as systematic interventions at distal outlets, instant hot water heaters, tanks (where present), air conditioning units, and cooling towers. There was semiannual monitoring of the water distribution system to identify spontaneous colonization. Also, hospitals performed active surveillance for *Legionella* infection for all cases of nosocomial pneumonia identified by clinical, radiological, and laboratory criteria.[3] If a patient had pneumonia with onset at least 2 days after admission to the hospital, urine specimens were collected and examined for *Legionella* antigen; if the results were negative, the test was repeated 5-7 days later. Testing was performed using the Biotest *Legionella* Urine Antigen EIA

TABLE. Distribution of Pneumonia Cases at the 20 Study Hospitals, by Patient Age

Age, y	No. (%) of cases
<40	17 (5)
40-59	48 (14)
60-80	159 (45)
>80	128 (36)

(Biotest AG), which detects all serogroups of *L. pneumophila* and even other *Legionella* species. Culture of respiratory secretions when possible was recommended, as was testing for specific antibodies on admission and after 15-20 days of hospitalization.

Definitions of confirmed or probable legionellosis, as well as confirmed or possible nosocomial infection, were based on national guidelines (and clinical, radiological, and laboratory findings).[4] The management of active surveillance was assigned to the chief of the hospital's infection control committee who, in collaboration with the infection control nurse, collected data about patients with nosocomial pneumonia and reported this information to our department. Our department telephoned the persons responsible for surveillance once every 2 weeks to ensure consistent monitoring.

At the start, the project involved 32 hospitals; however, the number of participating facilities dropped to 24 during the first year and then to 20 during the second year. The probable reason for this was that some hospital administrations feared legal action if had cases been identified and their facility's water distribution system had not been properly decontaminated.

Surveillance involved 325,703 patients. During the first year, 178 cases of nosocomial pneumonia were reported, and 174 cases were reported during the second year. The fatality rate was 12.7% (45 deaths). As expected, the age group most affected by pneumonia was patients aged 60 years or more (Table).

The cumulative incidence of reported pneumonia was 0.13% during the first year and 0.17% during the second. The distribution of cases by hospital is shown in the Figure.

During the 2-year course of the study, only 1 case of legionellosis was identified. *L. pneumophila* serogroup 3 was isolated from bronchoalveolar lavage samples from a patient in a hospital contaminated with this microorganism. The case was defined as nosocomial legionellosis even though, according to the attending physicians, the clinical relevance was uncertain and the criteria for absolute certainty did not appear to be fully satisfied. During the study, only 17 hospitals stated that they had systematically carried out maintenance according to the instructions they received. The environmental contamination levels did not appear to be affected by maintenance measures. The frequency of *Legionella*-positive samples was more or less the same over the course of the study, as was the frequency of the species of *Legionella* isolated.

The results of our study confirm that the presence of *Legionella* in a hospital's water distribution system does not necessarily mean cases of legionellosis will occur,[5,6] nor, by the same token, does a reduction or absence of contamination guarantee that cases of legionellosis will not occur.[7]

The incidence of nosocomial pneumonia was less than expected (0.5%-1%, according to Centers for Disease Control and Prevention figures).[8,9] Nonetheless, these cases occurred at hospitals colonized by *L. pneumophila* other than serogroup 1 (ie, strains of lower pathogenicity), in which there were fewer particularly critically ill patients than in large hospitals in Piedmont. This interpretation was confirmed by the exception of hospital number 2 (Figure), in which a higher incidence was found because the hospital admits patients with infectious diseases, including human immunodeficiency virus infection.

Furthermore, retrospective analysis of the radiographic documentation from the 2-year study period confirmed that the 3 hospitals reporting no cases had followed the protocol. All 3 are part of the same hospital administration.

The concept that pneumonia surveillance is a primary and indispensable objective in the prevention and control of nosocomial legionellosis was strengthened by our data and accepted by hospital administrators. This practice limits or even eliminates costly environmental interventions that may sometimes damage the water distribution system and are always

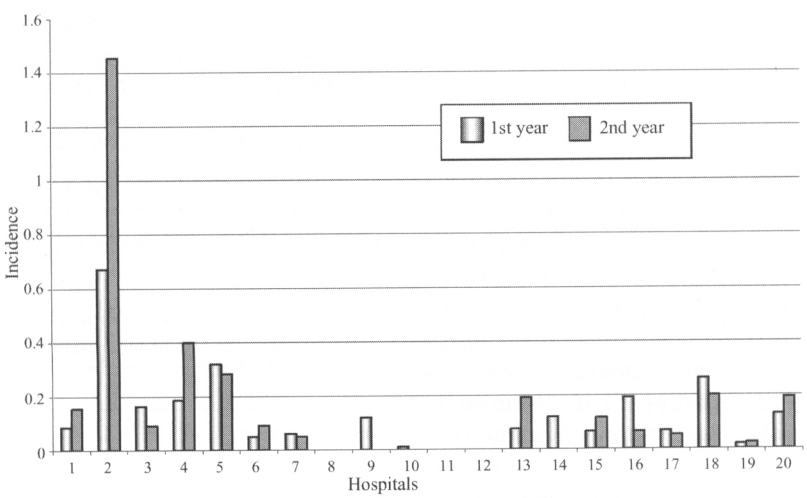

FIGURE. Distribution of pneumonia cases, among the 20 hospitals in the study

https://doi.org/10.1086/513118 Published online by Cambridge University Press

ineffective in the long run. Moreover, it satisfies ethical criteria, in that when a case of legionellosis is identified, adequate treatment can be instituted promptly.[10] Regular environmental interventions to reduce the risk of infection should be reserved for departments with high-risk patients. The participating hospitals were encouraged to institute pneumonia surveillance practices, which had important implications for devising strategies to control nosocomial infections. Most hospitals continued surveillance beyond the end of the project. The practice of regular maintenance of water distribution systems was introduced and consolidated in those hospitals where it had been neglected.

We believe we have provided useful additions to the ongoing discussion about methods for preventing hospital-acquired legionnaires disease. In agreement with numerous published studies, we confirmed that *L. pneumophila* other than serogroup 1 is less pathogenic than isolates from serogroup 1, and we confirmed that the presence of *Legionella* in the water distribution system does not necessarily mean that cases of legionellosis will occur.

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ACKNOWLEDGMENTS

We thank Kenneth Britsch for the translation of this paper.

Supported by a grant from Ministero dell'Istruzione Università e Ricerca (funds COFIN 2002).

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Infect Control Hosp Epidemiol 2007; 28:509-511

 0899-823X/2007/2804-0027$15.00. DOI: 10.1086/518096

REFERENCES

1 Ditommaso S, Guidetti L, Giacomuzzi M, et al. Contaminazione da *Legionella* degli impianti idrici piemontesi. *View Review Hospital* 2000; 1: 11-15.

2 Ditommaso S, Biasin C, Giacomuzzi M, Zotti CM, Cavanna A, Ruggenini Moiraghi A. Peracetic acid in the disinfection of a hospital water system contaminated with *Legionella* species. *Infect Control Hosp Epidemiol* 2005; 26:490-493.

3 Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections, 1988. *Am J Infect Control* 1988; 16:128-140.

4 Conferenza permanente per i rapporti tra lo stato le regioni e le province autonome di Trento e Bolzano. Linee guida per la prevenzione ed il controllo della legionellosi. Gazzetta Ufficiale della Repubblica Italiana no. 103. May 5, 2000.

5 Alary MA, Joly JR. Factors contributing to the contamination of hospital water distribution systems by *Legionellae. J Infect Dis* 1992; 165:565-569.

6 Marrie TJ, MacDonald S, Clarke K, Haldane D. Nosocomial Legionnaires' disease: lessons from a four year prospective study. *Am J Infect Control* 1991; 19:79-85.

7 Ditommaso S, Biasin C, Giacomuzzi M, et al. Colonization of a water system by *Legionella* and nosocomial legionellosis: a 5-year report in a large Italian hospital. *Infect Control Hosp Epidemiol* 2006; 27:532-535.

8 Craven DE, Steger KA , Barber TW. Preventing nosocomial pneumonia: state of the art and perspectives for the 1990s. *Am J Med* 1991; 91: 44S-53S.

9 Horan TC, White JW, Jarvis WR, et al. Nosocomial infection surveillance, 1984. *MMWR CDC Surveill Summ* 1986; 35:17SS-29SS.

10 Yu VL. Resolving the controversy on environmental cultures for legionella: a modest proposal. *Infect Control Hosp Epidemiol* 1998; 19:893-897.